The period of Evolutionary Synthesis (1930-1950)

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Exercise 1 (home group, individual work):

Read the following text carefully. Your task is to fill in the missing words and phrases, which you know from your biology lessons. If you need help, you can...

- ...go back in the text **or**
- ...read further **or**
- ...regard the figures carefully.

If you have problems understanding the text, write down your questions!

Six prominent scientists, **Theodosius G. Dobzhansky, Ernst Mayr, George Simpson, Julian S. Huxley, Bernhard Rensch** and **George L. Stebbins**, have been particularly involved in further developing evolutionary theory. Their findings have been united in the period of evolutionary synthesis (S*ynthesis* = combination).

In the beginning of this time period, **Ronald A. Fisher** focused on sexual selection. Whereas Charles Darwin was able to observe sexual selection only, Fisher was now able to explain this evolutionary factor. He revealed that both the female trait 'preference' and the male trait 'ornament', i.e. the peacock's tail, are coded genetically. Based on this assumption, he proposed the _____-process. This hypothesis describes that male ornaments become bigger and/or more conspicuous by an automatism.

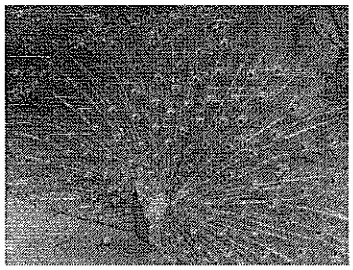

Fig. 1: The fan-out of a peacock.

The genes for the female trait 'preference' and the genes for the male trait 'ornament' are genetically associated, because females with a 'preference' for conspicuous ornaments mate with appropriate males and therefore the offspring bears both traits. Furthermore, he explained that once a male trait becomes too big and/or conspicuous, it will be restrained by other selection processes (i.e. increased conspicuousness for predators, increased susceptibility to disease). Fishers' hypothesis on the runaway-process is able to account for the evolution of ornaments which are bigger and/or more conspicuous than required in the attempt to survive.

Another important component of evolutionary biology was **Ernst Mayrs'** definition of the biological _____ in 1942. Ernst Mayr was not the first scientist who dealt with this issue. However, in contrast to the morphological species concept, he emphasized the common gene pool (total number of all genes in a population) and the reproductive isolation of a species (fig. 2).

Charles Darwin, the prime father of the evolutionary theory, used the term species but never defined it.

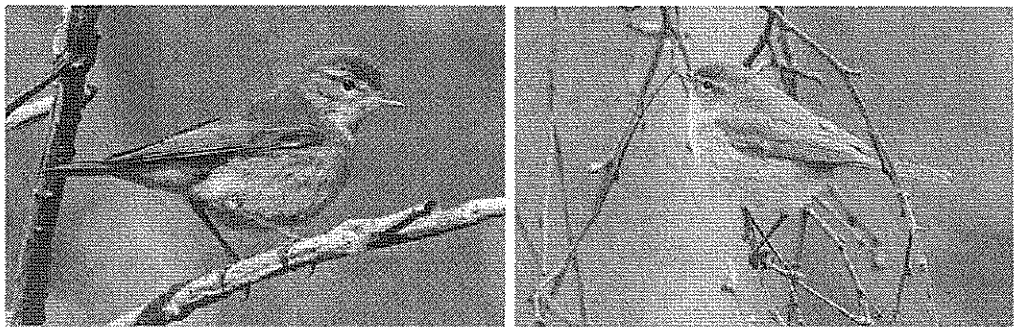

Fig. 2: Very similar but still different: Willow Warbler (left; © Jörg Kretzschmar, 2009) *and Chiffchaff* (right; ©, 2008, CC-Lizenz (BY 2.5) http://creativecommons.org/licenses/by/2.5/de/deed.de; Source: www.wikipedia.de)

In 1947, **Bernhard Rensch** studied the origin of new species (speciation). He differentiated two processes (fig. 3): the evolutionary change of various characteristics in each descendant (_____) und the branching of a lineage into two or more descendant lines (_____). Rensch came to this conclusion due to the discovery of fossils, which document these two processes of evolution. Furthermore the scientist explained the branching of two species by the mechanism of geographical isolation. This evolutionary mechanism cannot be attributed to mutation, recombination and selection and was first described by Ernst Mayr. Charles Darwin also considered geographical isolation to be a mechanism of speciation, but rejected this idea later. Today, additional mechanisms of speciation have been described by researchers.

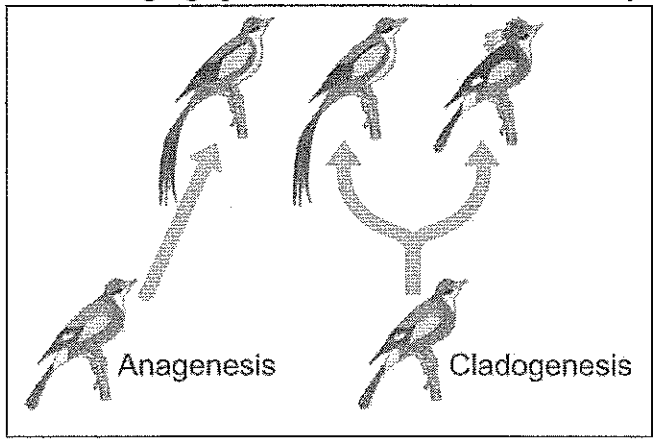

Fig. 3: Processes of anagenesis and cladogenesis.

The mechanism of _____ was first described by **Sewall Wright** in 1931 and was integrated into evolutionary theory in 1950. Wright's discovery is also named Sewall-Wright-effect and characterizes the random fluctuation in the frequency of alleles. Therefore, the Sewall-Wright-effect is an evolutionary factor, which is independent of natural selection. The process described by Wright is especially important for small populations, where random changes in the frequency of alleles have serious influence.

In the middle of the 20th century the contributions of the aforementioned scientists were integrated in _____. This great theory combines classical Darwinism and modern findings of genetics, population genetics and systematics. Genetic drift, moreover, was identified as an additional evolutionary factor.
According to evolutionary synthesis, mutation and recombination constantly cause genetic variations, whereas selection and genetic drift constrain these. The geneticist Theodosius Dobzhansky declared in these days: "Nothing in biology makes sense except in the light of evolution."

Exercise 2 (expert group, teamwork)

Check your cloze texts and your reading comprehension for correctness. Subsequently answer the following questions:

a) Ronald A. Fisher explained that a male ornament trait, which becomes too "expensive", will be constrained by other selection processes. Which costs has a peacock to bear in his natural environment due to his ornate train?

b) Do organisms, which look externally similar, necessarily belong to the same species, according to Ernst Mayr's biological species concept?

c) Why is the evolutionary factor discovered by Sewall Wright independent of natural selection?

d) Explain the citation of Theodosius Dobzhansky using the example of sexual dimorphism.

Exercise 3 (expert group, individual work)

Copy the terms you filled into the gaps of the cloze text (everything that is underlined) onto the 'milestone-cards' (see last page of the material). There is one card for each milestone from the period of the evolutionary synthesis (just the two discoveries from Bernhard Rensch have to be noted on one card!).

Exercise 4 (home group, teamwork):

Each of you is asked to present the milestones of his/her period to the other team members by attaching the milestone-cards chronologically to the time bar. The expert for the period of Darwinism starts. For each milestone-card, the expert explains, which person arrived at which insight by which means and how the insight changed evolutionary theory. Afterwards, the next expert follows until the time bar is completed.

Exercise 5 (home group, teamwork):

After completing the time bar, your team creates a concept map with as many connections as possible.

1.) Choose at least 12 milestones from the time bar (each period should be included).

2.) Write down the term from each milestone on a piece of paper.

3.) Arrange the pieces on a blank sheet so that the milestones which have a close connection lie close to each other. Consider what kind of relationship exists between the different milestones.

The following advices my help you:

The relation between two terms can be that …

… one term is an example of the other term (i.e.: mimicry is an example of natural selection).

… one term is part of the other term in the sense of a whole – part relationship (i.e.: chromosomes contain genes).

… terms are superordinate or subordinate concepts (i.e. mutation and selection are evolutionary factors).

4.) If you are satisfied with the arrangement of the milestones and the relations between them, glue the pieces of paper on the blank sheet.

5.) Now draw arrows between the terms.

6.) Describe the relationship above the arrows.